Tecnews

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A SIMPLE PHASE MODULATION UNIT.

By Clayton F. Bane, W6WB

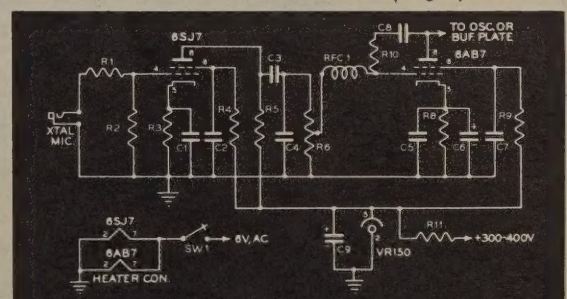
Since the FCC has now seen fit to permit narrow-band phase or frequency modulation to be used throughout the entire phone portions of the 75 and 20 meter bands, (as of March 1, 1952) it would appear that a revival of this subject might be timely. The simple unit discussed herein can be used to phase modulate any exciter using an oscillator or buffer stage whose basic frequency range lies in the 1750 to 2000 kc region. (This requirement is met in all of the Collins exciters). All elements in this particular unit were very carefully worked out; several different types of output tubes being tried and literally dozens of RC combinations for the phase-shift network. The ultimate result is a unit that has no "Bugs" and one that will provide a maximum degree of phase shift with low distortion.

As far as reception is concerned, phase modulation ultimately comes out the same as frequency modulation but the two basic systems are quite different with many definite advantages on the side of PM. First of all, a conventional NFM unit incorporates a reactance tube which is connected across all, (or part) of the frequency determining circuit of an oscillator. When so connected, the reactance tube necessarily adds a substantial amount of shunt capacity and throws off the dial calibration of the oscillator. This condition, while surely objectionable, is still not the greatest evil of the reactance tube.

Line voltage changes, with consequent plate and filament voltage variations, necessarily effect the reactance tube which in turn effects the frequency of the oscillator. The bad part about this is that very minor changes in reactance magnify into substantial changes in oscillator frequency. Additionally, this type of NFM system is particularly susceptible to hum and one rarely ever hears a NFM signal whose resting carrier is steady enough to produce a clean beat note. Phase modulation does not appear to suffer from the same evils, at least not to the same degree. Observe that the phase shifting tube is not connected to the frequency determining element of the oscillator but rather to a tank circuit in the plate side of the oscillator or to the plate of a following buffer-doubler. The actual amount of phase shift that can be obtained at the fundamental frequency, (without distortion) is quite small and this fact limits the usefulness of the system to some extent. The original swing must be multiplied by succeeding stages in order to finally come out, (on an FM basis) with sufficient total swing to be useful. (±2 to 4 kcs) The circuit under consideration is an adaptation of the basic Armstrong system used in a great many commercial PM Broadcast transmitters. Offhand, it doesn't look applicable to amateur operation since the initial phase change is extremely small and the necessary frequency multiplication extremely high. The commercial folks however are concerned with a wide frequency shift, (±75 kcs) and an extremely low overall distortion figure. We, as amateurs, only have to swing a few kilocycles and the total distortion on voice transmissions can rise to rather high values before it becomes objectionable. In any case, this unit will provide more shift at 14 mcs than can be accommodated by the average communications receiver using slope detection for reception.

Unlike conventional AM, neither FM nor PM offers anything in the way of peak power above that supplied by the constant carrier. The amplitude of the carrier doesn't change, 1 kw is 1 kw...period! One generally uses PM as an expedient...I use it because I can operate right through the hot TV hours and no one knows the difference. The carrier is constant therefore the TV set is not being subjected to amplitude changes as you talk,...there is no audio rectification problem so the TV or BC

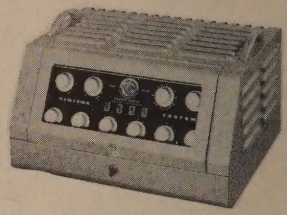
(Continued on rear page)



R1-100K.	R8-470 ohms.	C3-.01 mfd.
R2-4.7 megs.	R9-1800 ohms.	C4-.003 mica.
R3-1800 ohms.	R10-100K.	C5-.002 mica.
R4-1.5 megs.	R11-7500 ohms.	C6-.10mfd.25V.
R5-470K	10W, W/W.	C7-.003 mfd.
R6-500K pot.	C1-10 mfd.25V.	C8-.00025 mica.
R7-Not used.	C2-.05 mfd.	C9-10mfd.450WV.

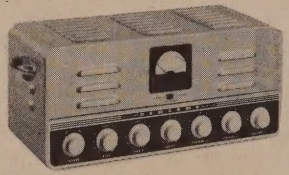
Newcomb TH

NEWCOMB CUSTOM K SERIES AMPLIFIERS



KX-25 POWER OUTPUT: 25 watts design center rating, 30 watts max. at less than 3% distortion any output tap. PEAK POWER: 40 watts design center, 48 watts max. INPUTS (6): 5 mike (2 meg.), gain 123 db; 1 phono either Magnetic input gain 99 db based on 27,000 ohm input, bass equalization +10 db or Crystal input ½ meg. gain 90 db REMOTE CONTROL: Use RC-6 remote control unit. BASS TONE CONTROL: Range —16 to +25 db. TREBLE TONE CONTROL: Range —30 to +20 db. HUM: —80 db controls off, —75 db crystal phono, —65 db mike and magnetic pickup inputs (Referred to rated output). CONTROLS (15): 5 mike, 1 phono, 1 bass, 1 treble, 4 bandwidth, 1 master, 1 volume indicator (all under keylocked control cover) A.C. power switch. TUBES (15): 6—6SC7, 2—6J5, 1—6J7, 1—6SQ7, 1—6SN7, 2—6L6G, 1—6AF6G, 1—5U4G. POWER CONSUMPTION: 135 watts, 117 volts 60 cycles A.C. Max. Input 129 volts. DIMENSIONS: 9⅜″ x 17¾″ x 14¾″. WEIGHT: 38½ lbs.

NEWCOMB DELUXE H SERIES AMPLIFIERS

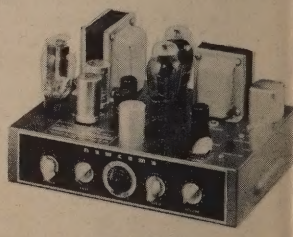


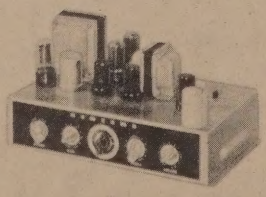
H-4 Mixer Pre-Amplifier with builtin power supply. Extremely low hum. Suitable for feeding telephone lines or booster amplifier, such as the H-25B or H-50B. Output +22 db at less than 5% distortion. +21 db at less than 2%. INPUTS for three mikes (2 meg.), gain 90 db. 1 phono (½ meg.), gain 51 db. HUM: Better than —80 db from phono input or —75 db, mike inputs. Requires RC-3 remote control unit. Includes master control and genuine VU meter with meter range extension switch. BASS TONE CONTROL: Range —16 to +14 db. TREBLE TONE CONTROL: Range —27 to +13 db. Output 500-600 ohms C. T. TUBES (7): 3-6SF5, 1-6SJ7, 1-6SN7, 1-6J5, 1-6X5. POWER CONSUMPTION: 30 watts, 117 volts 60 cycles A.C. max. Input 129 volts. Size: 8⅜″x19″x10½″. WT: 17½ lbs.

PHONOGRAPH AMPLIFIERS

KXLP-30 A phonograph amplifier unsurpassed by any other in the field, regardless of price. Ample power permits use of KX Series dual tone control circuit. Provides tonal range and balance unattainable in less costly circuits, and controlled emphasis of desirable but power-consuming fundamental bass tones, avoiding emphasis of harmonic bass—the "Boomy" or one-tone bass so unacceptable to true music lovers. U/L approved. Features "Magic Red Knob" Record Condition Compensator and built in magnetic pick-up pre-amplifier.

SPECIFICATIONS: POWER OUTPUT: 30 watts at less than 5% distortion with flat power output versus frequency curve. FREQUENCY RESPONSE: 20 to 20,000 cycles ±1 db. Response of magnetic and variable reluctance inputs corrected for requirements of these pickups. INPUTS: For radio and choice of crystal or variable reluctance pickup inputs. GAIN: Crystal input, 90 db. at ½ meg. input impedance. Magnetic or variable reluctance input, 112 db. at ½ meg. input impedance or 95 db. at 10,000 ohms. Signal required at radio input for full output is 6.6 volts. TONE COMPENSATION: Bass tone control, 0 to +22 db. with special curve shape for maximum emphasis of fundamental bass tones and minimum emphasis of harmonic bass. Treble tone control —25 db. to + 25 db. Automatic bass compensation of volume control from 0 db. bass boost at full volume to +10 db. at lowest volume. Fixed bass compensation (magnetic or variable reluctance input only) +10 db. RECORD CONDITION COMPENSATOR: Five positions: No. 1, radio; No. 2, records, condition "A" (Perfect); No. 3, records, condition "B"; No. 4, records, condition "C"; No. 5, records, condition "D" (badly worn, very noisy). CONTROLS (5): Power switch, bass tone control, Magic Red Knob control, treble tone control, volume control. CONTROL PANEL: Genuine etched metal. HUM BALANCER CONTROL: To correct for variations in tubes. OUTPUT IMPEDANCES: 4, 8, 16, and 500 ohms to octal socket. POWER CONSUMPTION: 150 watts, 129 volts, 60 cycles A.C. for use on 105-129 volts. TUBES (7): 1-6SC7, 3-6J5, 2-6L6G, 1-5U4G. DIMENSIONS: Chassis: 13½″ x 9½″ x 3″. Height overall, 7⅛″ WEIGHT: 22 lbs.





HLP-14 Brings to music lovers new listening pleasure in a unit less expensive than the KXLP-30. It, too, features the "Magic Red Knob" record condition compensator. Built-in pre-amplification and equalization, required for new low level pickups, make the HLP-14 ideal for the lower cost home installation. Exceptional tonal balance at whisper volumes is an outstanding feature. U/L approved.

SPECIFICATIONS: POWER OUTPUT: 14 watts at less than 5% distortion with wide flat power output versus frequency curve. PEAK POWER OUTPUT: 19 watts. FREQUENCY RESPONSE: 30 to 15,000 cycles ±1 db. for crystal pickup and radio inputs. Magnetic and variable reluctance inputs have response adjusted to requirements of these pickups. INPUTS: Same as KXLP-30. GAIN: Crystal input 90 db. at ½ meg. input impedance. Magnetic or variable reluctance input 109 db. at ½ meg. or 92 db. at 10,000 ohms impedance. Signal from radio required for full output is 4.2 volts. TONE COMPENSATION: Variable: Bass tone control 0 to +16 db. Treble tone control —29 db. to +12.5 db. Automatic bass compensation on volume control from 0 db. at maximum volume to +16 db. at lowest volume. Fixed bass compensation (Magnetic or variable reluctance input only) +10 db. RECORD CONDITION COMPENSATOR: (Same as KXLP-30). CONTROLS (5): Power switch, bass tone control, record compensator and radio selector, treble tone control, volume control. CONTROL PANEL: Etched metal. OUTPUT IMPEDANCES: 4, 8, 16, and 500. POWER CONSUMPTION: 75 watts, 129 volts, 60 cycles A.C. for use on 105-129 volts. TUBES (6): 1-6SC7, 1-6SJ7, 1-6J5, 2-6V6GT and 1-5Y3GT. DIMENSIONS: Chassis, 13½″ x 8-1/16″ x 3″. Height overall, 6¾″. WEIGHT, 13 lbs.

SOUND OF QUALITY

NEWCOMB STANDARD E SERIES AMPLIFIERS

E-25MP **PHONO TOP MOBILE AMPLIFIER** . . . A full 25 watts from either 6 V. Storage Battery or 117 V.A.C. at new low price. Consumes least possible current per watt output. "Stand-by" switch reduces battery consumption, keeps tubes warm for instant use. Separate A.C. power and turntable switches. Heavy duty Jones plugs and receptacles provide dependable connections to battery or A.C. power source.
SPECIFICATIONS . . . POWER OUTPUT: A full 25 watts at less than 5% distortion from either 117 volts A.C. or 6-volt storage battery. RESPONSE: ±2 db, 50-15,000 cycles. INPUTS for two mikes (2 meg.) gain 119 db; and one phono (½ meg.), gain 78 db. HIGH FREQUENCY ATTENUATOR range, 28 db. CIRCUIT FEATURES: Multi-stage inverse feedback, resistance capacity coupling, phase correction for phono motor, 2000 volt Hermetically sealed oil buffer condenser. OUTPUT IMPEDANCES: 4, 8, 16, and 500 ohms to two octal speaker sockets and impedance selector. PHONOGRAPH MOTOR: Constant speed 78 R.P.M. PICKUP: Crystal. TUBES (7): 1-6SC7, 1-6SJ7, 1-6J5, 2-6L6, 2-6X5GT. POWER CONSUMPTION: 107 watts at 117 volts, 60 cycles A.C. or 20.5 amps including phono motor from 6-volt storage battery. FINISH: Silver gray hammertone baked enamel. PANEL: Etched metal, illuminated. DIMENSIONS: (including cover) 8¾" x 14⅛" x 10" high overall. WEIGHT: 26 lbs.

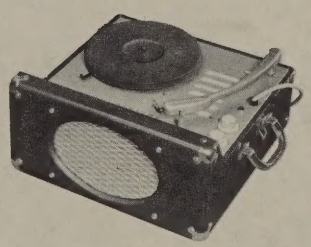
TRANSCRIPTION PLAYERS AND PUBLIC ADDRESS SYSTEMS

R-12

The Model R-12 brings "Console" quality to the portable phonograph field for the first time. Here is excitingly rich full toned reproduction and astonishing volume in a carrying case only 13¾" x 14⅛" x 7¾" weighing only 20 lbs. It's the most ruggedly built instrument of its type you've ever seen and it's priced within the reach of all. It's fully Underwriters Approved for your safety. All shock hazard is avoided by full AC construction. Packed into this small size and weight is a powerful 5 watt amplifier with inverse feedback, a 3 speed turntable with high quality featherweight crystal pickup and a large 6" x 9" oval Alnico No. 5 dynamic speaker. You can play every type of record—33⅓, 45, or 78 RPM of any size up to and including 12" diameter. The operating panel includes a tone control and pilot light in addition to the volume control.

The ultra modern feather weight pickup assures unbelievably long record life and is protected from the groove skipping which has plagued microgroove pickups in the past by Newcomb's exclusive "floating sound" construction. The carrying case is of plywood construction covered in rich washable fabricoid selected for its wear resistance qualities and beauty. Metal corners give added strength and protection. Speaker grill is kickproof punched metal.

Designed particularly for teachers and school music appreciation classes, it is also the ideal instrument for music lovers who travel, and for sororities, fraternities, small square dance clubs, and college students. It is also the perfect counter record demonstrator for record shops. In fact, wherever portability, full toned reproduction, and ruggedness are important, the R-12 will be found unquestionably the best, it's backed by over 12 years of fine sound equipment production, and it's priced much less than you'd expect.



R-16

The R-16 offers schools a really 1st class U/L approved transcription player and P.A. system at a weight women teachers can easily carry and at a price all schools can afford. Weighing only 22 lbs. and neatly packed into a case only 14" x 15" x 8½" is amazing performance and ruggedness. The R-16 is the nearest thing to the incomparable Newcomb TR-16 that can be built for women to carry. A 5 watt straight A.C. amplifier with inverse feedback in conjunction with an efficient 10" Alnico No. 5 dynamic loudspeaker provides exceptional volume and full tone range adequate for the majority of needs. A microphone input jack and mixing volume control permit the use of a microphone making the R-16 a practical P.A. system. The speaker section of the case is removable—25 ft. cable allows it to be placed as desired for best coverage. It is ideal for broadcast stations, advertising agencies, and sales meetings. It plays all records whether 33⅓, 45, or 78 RPM up to 17¼" in diameter. Unique and exclusive Newcomb "Floating Sound" feature prevents pickup skipping so common to most microgroove pickups due to mechanical shock from bumps, jars, or dancing feet. Operating panel includes pilot light, tone control, microphone volume control and phonograph volume control. The speaker is protected by a heavy kickproof grill and the case is all plywood construction covered in rich washable fabricoid that is remarkably wear resistant.

Just the sort of equipment you would expect from Newcomb engineers—one that you can depend upon in every way. An instrument that offers more of what you want at the lowest possible price.

(Continued from front page)

set owner can't hear you except in the rare instance where one of your harmonics falls directly in a television voice,(FM) channel. Carrier-power for carrier-power, the 100% plate modulated station will talk over you. However, PM might not come out too badly if stacked up against some of the "Clamp tube" systems. With PM, the output tubes can be run at full rating, plate efficiency can be maximum, coupling can be set for optimum power output. On tetrodes, the screen voltage can be raised to the maximum limits for highest efficiency. Considering a possible 75% efficiency for PM against a probable 50% for the clamp tube systems, the peaks on the latter wont greatly exceed your own output. You wont take up any more space in the band, probably not as much.

Note from the circuit diagram that the phase tube derives its plate voltage from the tube to which it is connected. (This places the output of the phase tube in parallel with the associated tank circuit). The addition of the phase tube may necessitate slight retuning of the tank although it might be well to note that in some cases a slight detuning of the tank, (to one side or the other) may result in greater shift with a given audio gain control setting. In any case, don't use shielded wire. The most important circuit element is the phase shifting network, R8 and C10. Keep these leads short and direct.

This unit has one interesting characteristic in that there is a definite limit to the maximum swing at fundamental frequency. Everything goes to pieces when this maximum is exceeded and the resulting distortion is bad indeed. Fortunately, this "Stop" point is easy to determine since it occurs simultaneously with a kick, (up or down or both) in final amplifier grid current. Keep the mike gain down below this critical point. Make the initial gain control setting by listening to the signal at the operating frequency with the exciter working but with the final off. The correct final setting of the mike gain control is established when the audio recovery is maximum in your receiver. (Without distortion) Don't solicit advice from the other fellow...his receiver is probably much the same as your own. PM is far less critical in swing adjustment than conventional FM.

It is important that the tank circuit, (to which the phase tube is connected) be at the lowest possible frequency. If your oscillator covers 1750 to 2000 kcs and has a tuned plate tank, connect to the latter. It should likewise be possible to connect to the plate circuit of a stage doubling to 75 meters, provided operation is confined to 10 and 20.

The swing obtained with PM modulation is not constant with audio frequency, i.e., the swing is progressively greater as the input audio frequency is increased. Commercially, this is compensated in the receiver with a suitable network. The shunt capacitor, C4 in this unit levels off the high frequency response at the transmitter and, when a crystal microphone is used, the balance between highs and lows is excellent.

Thanks to Lee Owens, W6IFW and to the Collins Co., for circuit details and other useful information. Thanks also to W6DMN for his great patience in conducting dozens of preliminary tests which ultimately led to our present PM unit.

SETS
ANTENNAS **Complete Television Stocks !** ROTATORS
ACCESSORIES

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